

High-Temperature, Wirebondless, Ultra-Compact Wide Bandgap Power Semiconductor Modules for Space Power Systems, Phase II

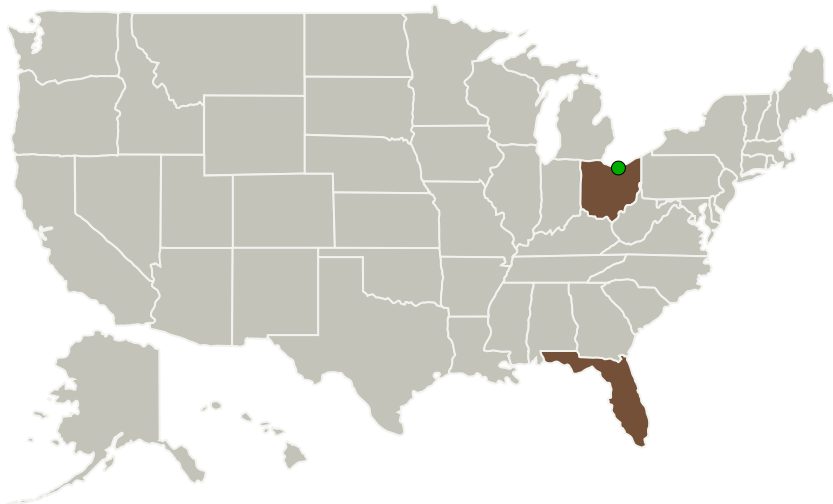
Completed Technology Project (2011 - 2013)



Project Introduction

Silicon carbide (SiC) and other wide band-gap semiconductors offer great promise of high power rating, high operating temperature, simple thermal management, and ultra-high power density for both space and commercial power electronic systems. However, this great potential is seriously limited by the lack of reliable high temperature device packaging technology. The objective of this proposed research is to develop a ultra-compact, hybrid power module packaging technology based on the use of double leadframes and direct leadframe-to-chip transient liquid phase (TLP) bonding that allows device operation up to 450 degrees Celsius. The unique advantages of this innovative solution include very high current carrying capability, low package parasitic impedance, low thermo-mechanical stress at high temperatures, double-side cooling, and modularity for easy system-level integration. The new power module will have a very small form factor with 3-5X reduction in size and weight from the prior art, and capable of operating from 450C to -125C.

Primary U.S. Work Locations and Key Partners



High-Temperature,
Wirebondless, Ultra-Compact
Wide Bandgap Power
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Organizations Performing Work	Role	Type	Location
APECOR	Lead Organization	Industry Small Disadvantaged Business (SDB)	Orlando, Florida
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations

Florida	Ohio
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Project Transitions

**June 2011:** Project Start**May 2013:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/138950>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

APECOR

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

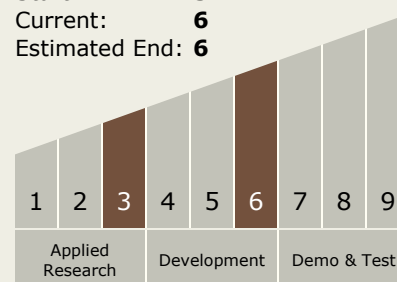
Carlos Torrez

Principal Investigator:

John Elmes

Technology Maturity (TRL)

Start: 3
Current: 6
Estimated End: 6



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Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
 - └ TX03.1 Power Generation and Energy Conversion
 - └ TX03.1.4 Dynamic Energy Conversion

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System